

## PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>TELL 11 PCT</b>	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. <b>PCT/FI2004/000610</b>	International filing date (day/month/year) <b>13/10/2004</b>	Priority date (day/month/year) <b>14/10/2003</b>
International Patent Classification (IPC) or national classification and IPC <b>See Supplemental Box</b>		
Applicant <b>Tellabs Oy et al</b>		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
- a. ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- |                                     |              |   |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I    | Basis of the report   |
| <input type="checkbox"/>            | Box No. II   | Priority  |
| <input type="checkbox"/>            | Box No. III  | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/>            | Box No. IV   | Lack of unity of invention  |
| <input checked="" type="checkbox"/> | Box No. V    | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input checked="" type="checkbox"/> | Box No. VI   | Certain documents cited   |
| <input type="checkbox"/>            | Box No. VII  | Certain defects in the international application  |
| <input type="checkbox"/>            | Box No. VIII | Certain observations on the international application   |

Date of submission of the demand <b>08-08-2005</b>	Date of completion of this report <b>18-01-2006</b>
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer <b>Nabil Sebaa/MN</b> Telephone No. +46 8 782 25 00

Form PCT/IPEA/409 (cover sheet) (April 2005)

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

International application No.

**PCT/FI2004/000610**

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of: **Cover sheet**

**INTERNATIONAL PATENT CLASSIFICATION (IPC) :**

**H04L 12/56 (2006.01)**

**G06F 5/06 (2006.01)**

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000610

## Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☐ the international application in the language in which it was filed
- ☐ a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 14 as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- pages \_\_\_\_\_ as originally filed/furnished
- pages\* \_\_\_\_\_ as amended (together with any statement) under Article 19
- pages\* 15 - 18 received by this Authority on 12/01/2006
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- pages 1/3 - 3/3 as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI2004/000610

**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	<u>1-12</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-12</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-12</u>	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

The invention relates to a method and apparatus for controlling the congestion management and the scheduling of transmission link capacity in packet-switched networks. The problem to be solved by the invention concerns the risk of service quality reduction caused by overbooking which affects all service level classes, even though, overbooking is only performed on a specific service level class. Another problem to be solved relates to the length of a traffic queue that is difficult to limit in size as congestion arises from overbooking.

Documents cited in the International Search Report:

D1: WO02088879 A2  
D2: EP1137227 A2  
D3: EP1345365 A2  
D4: WO0028705 A1  
D5: US20020097734 A1  
D6: WO03052556 A2

The cited documents represent the general state of the art. The invention defined in claims 1-12 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed method and apparatus according to new claims 1-12 filed with the letter of 12.01.2006 for controlling the congestion management and the scheduling of transmission link capacity in packet-switched networks by implementing a scheduler and a congestion-limitation mechanism in such a way that the reduction in service quality arising from overbooking only

.../...

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

affects the service level class in which overbooking is used, and in addition can prevent an increase in the length of the queue that is detrimental to traffic-flow control, even in a congestion situation due to overbooking.

Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-12 is novel and is considered to involve an inventive step. The invention is industrially applicable.

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/FI2004/000610

## Box No. VI Certain documents cited

### 1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
GB2394856 A	05/05/2004	17/10/2003	29/10/2002

### 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)

Claims:

1. A method for controlling the congestion management and the scheduling of transmission link capacity in packet-switched telecommunications, in which method

- digital information is transmitted as constant or variable-length packets,
- identifier data is attached to the packets, on the basis of which the packets are divided into at least two different service level classes,
- on the basis of the service level class data, each packet is routed to one of the FIFO queues (3 - 5), which are one for each service level class,
- at least one service level class is such that identifier data is attached to the packets belonging to it, with the aid of which the packets are divided into at least two internal sub-groups (.e.g., drop precedence) in the service level class,
- the packets belonging to the same service level class form a flow, in which the transmission order of the packets is retained,
- the available capacity of the outgoing link or links of the system is scheduled (1) for the service-level-class-specific FIFO queues using a weighting-coefficient-based scheduling method, a priority-based scheduling method, or a combination of these methods,
- congestion in the service-level-class-specific FIFO queues is limited by dropping or marking (ECN, Explicit Congestion Notification [2]) packets in the queue or arriving in the queue,

characterized in that a packet-specific priority value in the priority-based scheduling and/or a weighting coefficient in the weighting-coefficient-based scheduling is defined from a joint effect of a variable  $q$  and a variable vector  $x$  and that a selection of packets within a specific service level class, to which packets dropping or marking will be applied in a congestion situation, are defined from an effect of the variable vector  $x$ , in which the variable  $q$  is defined from the service level class (CoS), to which the traffic represented by which the packet in question belongs, and the variable vector  $x$  is formed of the results provided by measurement (2) applied to the traffic flow representing the service level class being examined, said measurement results depending on temporal variation in data transmission speed of the traffic representing the traffic

flow being examined and on distribution between different sub-groups of packets representing the traffic flow being examined.

2. The method according to Claim 1 is characterized in that the temporal variation in the data transmission speed is depicted using a double-value variable, which states whether the number of bits transmitted during an arbitrary monitoring interval  $T$  from the past to the present is less than  $CIR \times T + CBS$ , in which  $CIR$  is the transmission band available to the service level class being examined (committed information rate [bit/s]) and  $CBS$  is the greatest permitted burst size (committed burst size [bit/s]).

3. The method according to Claim 1 is characterized in that the SFQ (Start-time Fair Queuing [1]) method is used as the weighting-coefficient-based scheduling method.

4. The method according to Claim 1 is characterized in that the WFQ (Weighted Fair Queuing [1]) method is used as the weighting-coefficient-based scheduling method.

5. The method according to Claim 1 is characterized in that the WRED (Weighted Random Early Detection [3, 4]) method is used as the congestion limitation method controlled by the variable vector  $x$ .

6. The method according to Claims 1 and 2 is characterized in that the information contained in the variable vector  $x$  is formed using the Token Bucket method [7].

7. Equipment for controlling the congestion management and scheduling of transmission link capacity in packet-switched telecommunications, in which the equipment includes

- means for receiving constant or variable-length packets carrying digital information,
- means for reading the identifier data attached to the packets, on the basis of which the packets can be divided into at least two different service level classes,
- means for dividing the packets into at least two different service level classes,
- a FIFO queue for each of the service level classes,
- means for routing a packet in the FIFO queue (3 - 5) corresponding the relevant service level class, on the basis of the service level class data,

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- means for reading identifier data attached to the packets, on the basis of which the internal sub-group (e.g., drop precedence) of the service level class, to which the packet in question belongs, can be determined,

- a scheduler (1) for scheduling the capacity available to the outgoing link or links from the system to the service-level-class-specific FIFO queues, using a weighting-coefficient-based scheduling method, a priority-based scheduling method, or a combination of these,

- means for sending packets to the outgoing link or links, in a transmission order defined by the scheduler,

- means for limiting the congestion of the service-level-class-specific FIFO queues (3 - 5), by dropping or marking (ECN, Explicit Congestion Notification [2]) packet in a queue or arriving in a queue,

characterized in that the equipment includes means, with the aid of which a packet-specific priority value can be defined in the priority-based scheduling and/or a weighting coefficient can be defined in the weighting-coefficient-based scheduling on a basis of a joint effect of a variable  $q$  and a variable vector  $x$ , and with the aid of which means selection of packets within the service level class, to which packets dropping or marking is applied in a congestion situation, can be defined from an effect of the variable vector  $x$ , in which the variable  $q$  is defined from a service level class (CoS), to which the traffic represented by which the packet in question belongs, and the variable vector  $x$  is formed of the results provided by measurement (2) applied to the traffic flow representing the service level class being examined, said measurement results depending on temporal variation in data transmission speed of the traffic representing the traffic flow being examined and on distribution between different sub-groups of the packets representing traffic flow being examined.

8. The equipment according to Claim 7 is characterized in that the equipment includes means, with the aid of which a double-value variable can be formed, which states whether the number of bits transmitted during an arbitrary monitoring interval  $T$  from the past to the present is less than  $CIR \times T + CBS$ , in which  $CIR$  is the transmission band available to the service level class being examined (committed information rate [bit/s]) and  $CBS$  is the greatest permitted burst size (committed burst size [bit/s]).

9. The equipment according to Claim 7 is characterized in that the equipment includes means for performing weighting-coefficient-based scheduling using the SFQ (Start-time Fair Queuing [1]) method.

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10. The equipment according to Claim 7 is characterized in that the equipment includes means for performing weighting-coefficient-based scheduling using the WFQ (Weighted Fair Queuing [1]) method.

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11. The equipment according to Claim 7 is characterized in that the equipment includes means, with the aid of which congestion limitation controlled using the variable vector  $x$  can be performed using the WRED (Weighted Random Early Detection [3, 4]) method.

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12. The equipment according to Claims 7 and 8 is characterized in that the equipment includes means for forming the information contained in the variable vector  $x$  using the Token Bucket method [7].